

StarQ

Surface Treatment at Atomic Resolution for Quantum Computing

A major challenge for NV based Quantum Computers is still the control over the diamond surface. Surface defects can interfere with the qubits. We develop etching, termination and coating processes for diamond surfaces to reduce defects and minimize the influence of the diamond surface on the qubits.

- Enabling technologies
- NV Centers



The Diamond Ecosystem at the Innovation Center Ulm

The Innovation Center in Ulm combines the complete value chain:

- Diamond material development
- Diamond micro and nano structuring
- Diamond surface treatment
- Assembly and connection technology
- Diamond characterization
- Diamond based Quantum Computer manufacturing

Advanced Quantum
Spin-Characterization Setup

X E E Q
The Quantum Transcendence
Quantum Computer

expert optical solutions
Plasma processing

HIU HELMHOLTZ
INSTITUTE
ULM
Electrochemical Energy Storage
Surface analysis

diatope
CVD Growth & Implantation

DLR StarQ
Surface Treatments
Atomic Layer Etching
Atomic Layer Deposition
Surface Characterization
Individual NV Characterization
...

universität ulm
Surface analysis
Diamond Quantum
Sensing
Cleanroom
...

QCi DIAQ
Diamond CVD

uulm
Diamond CVD

QCi
FIB/SEM

DLR StarQ
Atomic Layer Etching

DLR StarQ
Atomic Layer Deposition

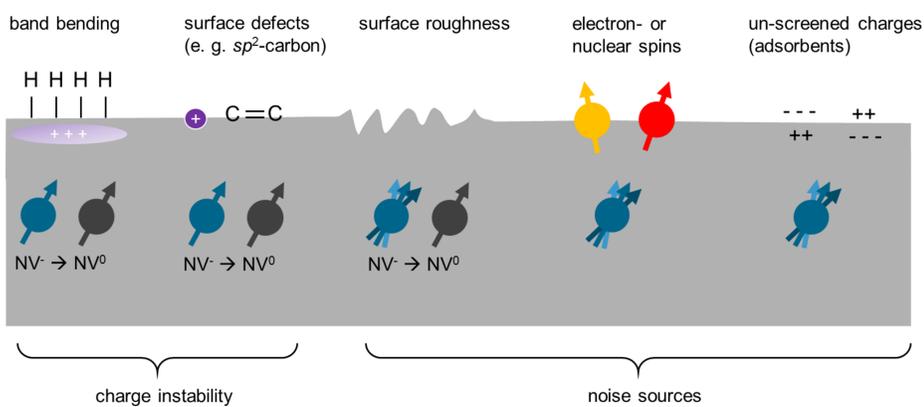
uulm
E-Beam Lithography

QCi
STED

QCi SQuAp
Confocal Microscopy

The challenges shallow NV centers

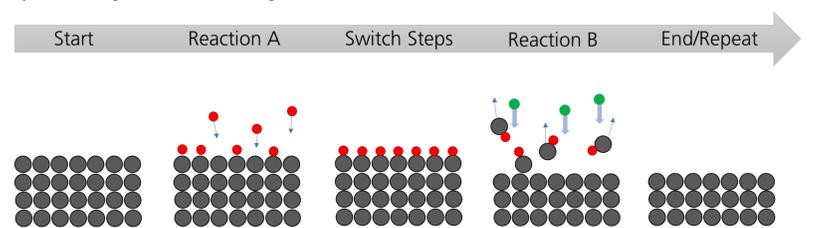
In order to achieve large coherence times of surface-near NV centers, the surface conditions must be controlled.



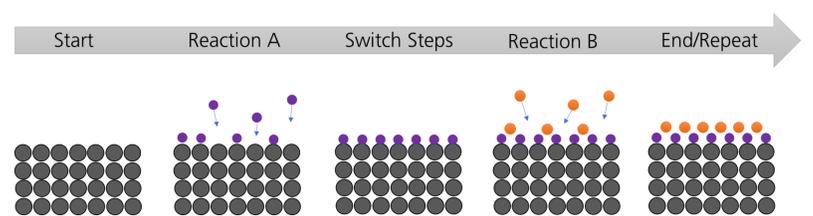
Surface treatments at atomic resolution

Besides other process technologies, such as thermochemical, photochemical, plasma treatments and wet-chemical treatments, surface etching and passivation technologies at an atomic resolution are developed and evaluated.

Atomic Layer Etching (ALE) for etching at atomic resolution



Atomic Layer Deposition (ALD) for coatings at atomic resolution



Project Goals

1. Surface cleaning and termination
2. Surface etching at atomic resolution
3. Surface coating at atomic resolution

Conclusions

- Successfully developing process technologies for improved coherence times of shallow NV centers
- A large ecosystem is grown in and around the Innovation Center in Ulm

More information about the project on our website



A project of
DLR Institute of
Quantum Technologies

Contractor
diatope | **Advanced Quantum**



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Get in touch.
We enable quantum!

